

## Editorial

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### CyberKnife® Robotic Stereotactic Radiosurgery

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Major sections of October and December issues of *Technology in Cancer Research and Treatment* (TCRT) are dedicated to the application of robotic stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT) using the CyberKnife® platform. Radiosurgical techniques, initially developed for intracranial applications require the precise targeting of multiple intersecting beams to a focused target. The expansion of traditional techniques using the Gamma Knife to various linear accelerator (linac) platforms required various solutions to overcome issues of accuracy in using non-frame based techniques. The CyberKnife® linac platform utilizes a robotic delivery mechanism coupled with real-time imaging to track and compensate for patient or target movement. Further development of techniques such as respiratory gating and body tracking has allowed expansion from intracranial SRS to multisystem SBRT.

Kilby and colleagues (1) review the rapidly evolving applications of SRS and SBRT using the Cyberknife VSI Robotic radiosurgery system discussing its enhanced dosimetric accuracy and inverse treatment planning algorithms in targeting a variety of tumor locations throughout the body. The authors provide a detailed review of geometric accuracy involving both phantom tests and patient data. In addition, Kilby *et al* propose that the technical advancements on the CyberKnife® VSI have allowed for more extended fractionation schemes similar to those seen with IMRT.

The histopathological effects of severely hypofractionated therapy, the hallmark of SRS/SBRT, is also detailed in a case report of a prostate cancer patient treated with SBRT by Oermann *et al* (2). Their histopathological evaluation of prostatic tissues treated with SBRT offers some insight on an area of little known tissue effects and represents an area ripe for clinical investigation.

A corollary review by Katz (3) summarized the clinical outcomes to date. Emerging data in over 300 patients appears to suggest treatment efficacy and more importantly, absence of long-term high-grade treatment toxicities of SBRT. In addition, Bolzicco and colleagues (4) also report promising biochemical control with little toxicity in an early clinical experience with prostate cancer. In patients with hepatocellular carcinoma (HCC), aggressive local therapy is necessary if curative intent is the goal. Increasingly, SBRT has been used as either an adjuvant to surgery, radiofrequency ablation or as primary therapy. The clinical outcomes reported by Louis *et al* (5) appear to confirm the efficacy of this approach with local control rates in excess of 90% in patients not otherwise eligible for other conventional approaches.

Complex tumors involving the cranial base represent challenges for the neurosurgeon and radiation oncologist. Incomplete resections are sometimes

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unavoidable in order to avoid injury to critical neurovascular structures. The residual mass lesions are often adjacent to radiation sensitive structures such as the optic chiasm and thus have proved challenging for radiation dose planning. Paravati and colleagues (6) describe a corridor based approach to skull base tumors using a combination of a novel, minimally-invasive endoscopic endonasal approach to benign and malignant tumors of the base of skull combined with traditional open approaches when needed, followed by adjuvant fractionated stereotactic radiosurgery (fSRS). The experience of 39 patients with a variety of benign and malignant histologies showed control rates of approximately 90% and progression-free survival of nearly 20 months. Based on their response rates and minimal adverse events, the authors concluded that this corridor based surgical approach followed by fSRS was a safe and effective management strategy for skull based tumors.

We believe this first of a 2-part special edition of TCRT focusing on robotic stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT) using the CyberKnife® platform will serve to inform the readers of the novel approaches

to some of the most challenging tumors encountered in the modern oncologic practice.

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